



SEQUENCE LISTING

<110> Smeekens, J.C.M.
Ebskamp, Michael
Geerts, Hendrikis
Weisbeek, Petrus

<120> Production of Oligosaccharides in Transgenic Plants

<130> ARNO-1-15313

<140> US 09/543,861

<141> 2000-03-24

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<151> 1998-02-05

<150> US 09/193,385

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<150> US 08/479,470

<151> 1995-06-07

<150> NL 1000064

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<160> 12

<170> PatentIn version 3.0

<210> 1

<211> 2094

<212> DNA

<213> Barley

<220>

<221> CDS

<222> (46)..(1923)

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Gly Lys Pro Pro Leu Pro Tyr Ala Tyr Lys Pro Leu Pro Ser Asp Ala
5 10 15 20

gcc gac ggt aag cgg acc ggc tgc atg agg tgg tcc gcg tgt gcc acc 153
Ala Asp Gly Lys Arg Thr Gly Cys Met Arg Trp Ser Ala Cys Ala Thr
25 30 35

gtg ctg acg gcc tcg gcc atg gcg gtc gtc gtc gtc ggc gcc acg ctc 201

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Leu	Ala	Gly	Leu	Arg	Met	Glu	Gln	Ala	Val	Asp	Glu	Glu	Ala	Ala	Ala	
		55					60					65				
ggc	ggg	ttc	ccg	tgg	agc	aac	gag	atg	ctg	cag	tgg	cag	cgc	agc	ggt	297
Gly	Gly	Phe	Pro	Trp	Ser	Asn	Glu	Met	Leu	Gln	Trp	Gln	Arg	Ser	Gly	
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tac	cat	ttc	cag	acg	gcc	aag	aac	tac	atg	agc	gat	ccc	aac	ggc	ctg	345
Tyr	His	Phe	Gln	Thr	Ala	Lys	Asn	Tyr	Met	Ser	Asp	Pro	Asn	Gly	Leu	
85					90					95					100	
atg	tat	tac	cgt	gga	tgg	tac	cac	atg	ttc	tac	cag	tac	aac	ccg	gtg	393
Met	Tyr	Tyr	Arg	Gly	Trp	Tyr	His	Met	Phe	Tyr	Gln	Tyr	Asn	Pro	Val	
				105					110					115		
ggc	acc	gac	tgg	gac	gac	ggc	atg	gag	tgg	ggc	cac	gcc	gtg	tcc	cgg	441
Gly	Thr	Asp	Trp	Asp	Asp	Gly	Met	Glu	Trp	Gly	His	Ala	Val	Ser	Arg	
			120					125					130			
aac	ctt	gtc	caa	tgg	cgc	acc	ctc	cct	atc	gcc	atg	gtg	gcc	gac	cag	489
Asn	Leu	Val	Gln	Trp	Arg	Thr	Leu	Pro	Ile	Ala	Met	Val	Ala	Asp	Gln	
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tgg	tac	gac	atc	ctc	gga	gtc	ctc	tcg	ggc	tcc	atg	acg	gtg	cta	ccc	537
Trp	Tyr	Asp	Ile	Leu	Gly	Val	Leu	Ser	Gly	Ser	Met	Thr	Val	Leu	Pro	
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aac	ggg	acg	gtc	atc	atg	atc	tac	acg	ggc	gcc	acc	aac	gcc	tcc	gcc	585
Asn	Gly	Thr	Val	Ile	Met	Ile	Tyr	Thr	Gly	Ala	Thr	Asn	Ala	Ser	Ala	
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Val	Glu	Val	Gln	Cys	Ile	Ala	Thr	Pro	Ala	Asp	Pro	Asn	Asp	Pro	Leu	
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ctc	cgc	cgg	tgg	acc	aag	cac	ccc	gcc	aac	ccc	gtc	atc	tgg	tcg	ccg	681
Leu	Arg	Arg	Trp	Thr	Lys	His	Pro	Ala	Asn	Pro	Val	Ile	Trp	Ser	Pro	
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ccg	ggg	gtc	ggc	acc	aag	gat	ttc	cga	gac	ccg	atg	acc	gcc	tgg	tac	729
Pro	Gly	Val	Gly	Thr	Lys	Asp	Phe	Arg	Asp	Pro	Met	Thr	Ala	Trp	Tyr	
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Asp	Glu	Ser	Asp	Glu	Thr	Trp	Arg	Thr	Leu	Leu	Gly	Ser	Lys	Asp	Asp	
	230					235					240					
cac	gac	ggc	cac	cac	gac	ggc	atc	gcc	atg	atg	tac	aag	acc	aag	gac	825
His	Asp	Gly	His	His	Asp	Gly	Ile	Ala	Met	Met	Tyr	Lys	Thr	Lys	Asp	
245					250					255					260	
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Phe	Leu	Asn	Tyr	Glu 265	Leu	Ile	Pro	Gly	Ile 270	Leu	His	Arg	Val	Val 275	Arg	
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Thr	Gly	Glu	Trp 280	Glu	Cys	Ile	Asp	Phe 285	Tyr	Pro	Val	Gly	Arg 290	Arg	Ser	
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Ser	Asp	Asn 295	Ser	Ser	Glu	Met	Leu 300	His	Val	Leu	Lys	Ala 305	Ser	Met	Asp	
gac	gaa	cgg	cac	gac	tac	tac	tcg	ctg	ggc	acg	tac	gac	tcg	gcg	gcc	1017
Asp	Glu 310	Arg	His	Asp	Tyr	Tyr 315	Ser	Leu	Gly	Thr	Tyr 320	Asp	Ser	Ala	Ala	
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Asn	Thr	Trp	Thr	Pro	Ile 330	Asp	Pro	Glu	Leu	Asp 335	Leu	Gly	Ile	Gly	Leu 340	
aga	tac	gac	tgg	gga	aag	ttt	tat	gcg	tcc	acc	tcc	ttc	tat	gat	ccg	1113
Arg	Tyr	Asp	Trp	Gly 345	Lys	Phe	Tyr	Ala	Ser 350	Thr	Ser	Phe	Tyr	Asp 355	Pro	
gcc	aag	aac	cgg	cgc	gtg	ctc	atg	ggg	tac	gtc	ggc	gag	gtc	gac	tcc	1161
Ala	Lys	Asn 360	Arg	Arg	Val	Leu	Met	Gly 365	Tyr	Val	Gly	Glu	Val 370	Asp	Ser	
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Lys	Arg	Ala 375	Asp	Val	Val	Lys	Gly 380	Trp	Ala	Ser	Ile	Gln 385	Ser	Val	Pro	
agg	acg	gtg	gct	ctg	gat	gag	aag	acc	cgg	acg	aac	ctc	ctg	ctc	tgg	1257
Arg	Thr 390	Val	Ala	Leu	Asp	Glu 395	Lys	Thr	Arg	Thr	Asn 400	Leu	Leu	Leu	Trp	
ccc	gtt	gag	gag	atc	gag	acc	ctc	cgc	ctc	aat	gcc	acg	gaa	ctg	acc	1305
Pro	Val	Glu	Glu	Ile 410	Glu	Thr	Leu	Arg	Leu	Asn 415	Ala	Thr	Glu	Leu	Thr 420	
gac	gtt	acc	att	aac	act	ggc	tcc	gtc	atc	cat	atc	ccg	ctc	cgc	caa	1353
Asp	Val	Thr	Ile	Asn 425	Thr	Gly	Ser	Val	Ile 430	His	Ile	Pro	Leu	Arg 435	Gln	
ggc	act	cac	gct	cga	cat	gcg	gag	gcc	tct	ttc	cac	ctt	gat	gct	tcc	1401
Gly	Thr	His 440	Ala	Arg	His	Ala	Glu	Ala 445	Ser	Phe	His	Leu	Asp 450	Ala	Ser	
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Ala	Val	Ala 455	Ala	Leu	Asn	Glu	Ala 460	Asp	Val	Gly	Tyr	Asn 465	Cys	Ser	Ser	
agc	ggc	ggc	gct	gtt	aac	cgc	ggc	gcg	cta	ggc	ccc	ttc	ggc	ctc	ctc	1497
Ser	Gly 470	Gly	Ala	Val	Asn	Arg 475	Gly	Ala	Leu	Gly	Pro 480	Phe	Gly	Leu	Leu	
gtc	ctc	gcc	gcc	ggt	gac	cgc	cgt	ggc	gag	caa	acg	gcg	gtc	tac	ttc	1545

val	Leu	Ala	Ala	Gly	Asp	Arg	Arg	Gly	Glu	Gln	Thr	Ala	Val	Tyr	Phe	
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Tyr	Val	Ser	Arg	Gly	Leu	Asp	Gly	Gly	Leu	His	Thr	Ser	Phe	Cys	Gln	
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Asp	Glu	Leu	Arg	Ser	Ser	Arg	Ala	Lys	Asp	Val	Thr	Lys	Arg	Val	Ile	
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Gly	Ser	Thr	Val	Pro	Val	Leu	Asp	Gly	Glu	Ala	Leu	Ser	Met	Arg	Val	
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Leu	Val	Asp	His	Ser	Ile	Val	Gln	Gly	Phe	Asp	Met	Gly	Gly	Arg	Thr	
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acg	atg	acc	tcg	cgg	gtg	tac	ccg	atg	gag	tcg	tat	cag	gag	gca	aga	1785
Thr	Met	Thr	Ser	Arg	Val	Tyr	Pro	Met	Glu	Ser	Tyr	Gln	Glu	Ala	Arg	
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gtc	tac	ttg	ttc	aac	aac	gcc	acc	ggt	gcc	agc	gtg	acg	gcg	gaa	agg	1833
Val	Tyr	Leu	Phe	Asn	Asn	Ala	Thr	Gly	Ala	Ser	Val	Thr	Ala	Glu	Arg	
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ctg	gtc	gtg	cac	gag	atg	gac	tcg	gca	cac	aac	cag	ctc	tcc	aat	gag	1881
Leu	Val	Val	His	Glu	Met	Asp	Ser	Ala	His	Asn	Gln	Leu	Ser	Asn	Glu	
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gac	gat	ggc	atg	tat	ctt	cat	caa	gtt	ctt	gaa	tct	cgt	cat			1923
Asp	Asp	Gly	Met	Tyr	Leu	His	Gln	Val	Leu	Glu	Ser	Arg	His			
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Ala Cys Ala Thr Val Leu Thr Ala Ser Ala Met Ala Val Val Val Val
35 40 45

Gly Ala Thr Leu Leu Ala Gly Leu Arg Met Glu Gln Ala Val Asp Glu
50 55 60

Glu Ala Ala Ala Gly Gly Phe Pro Trp Ser Asn Glu Met Leu Gln Trp
65 70 75 80

Gln Arg Ser Gly Tyr His Phe Gln Thr Ala Lys Asn Tyr Met Ser Asp
85 90 95

Pro Asn Gly Leu Met Tyr Tyr Arg Gly Trp Tyr His Met Phe Tyr Gln
100 105 110

Tyr Asn Pro Val Gly Thr Asp Trp Asp Asp Gly Met Glu Trp Gly His
115 120 125

Ala Val Ser Arg Asn Leu Val Gln Trp Arg Thr Leu Pro Ile Ala Met
130 135 140

Val Ala Asp Gln Trp Tyr Asp Ile Leu Gly Val Leu Ser Gly Ser Met
145 150 155 160

Thr Val Leu Pro Asn Gly Thr Val Ile Met Ile Tyr Thr Gly Ala Thr
165 170 175

Asn Ala Ser Ala Val Glu Val Gln Cys Ile Ala Thr Pro Ala Asp Pro
180 185 190

Asn Asp Pro Leu Leu Arg Arg Trp Thr Lys His Pro Ala Asn Pro Val
195 200 205

Ile Trp Ser Pro Pro Gly Val Gly Thr Lys Asp Phe Arg Asp Pro Met
210 215 220

Thr Ala Trp Tyr Asp Glu Ser Asp Glu Thr Trp Arg Thr Leu Leu Gly
225 230 235 240

Ser Lys Asp Asp His Asp Gly His His Asp Gly Ile Ala Met Met Tyr
245 250 255

Lys Thr Lys Asp Phe Leu Asn Tyr Glu Leu Ile Pro Gly Ile Leu His
260 265 270

Arg Val Val Arg Thr Gly Glu Trp Glu Cys Ile Asp Phe Tyr Pro Val
275 280 285

Gly Arg Arg Ser Ser Asp Asn Ser Ser Glu Met Leu His Val Leu Lys
290 295 300

Ala Ser Met Asp Asp Glu Arg His Asp Tyr Tyr Ser Leu Gly Thr Tyr
305 310 315 320

Asp Ser Ala Ala Asn Thr Trp Thr Pro Ile Asp Pro Glu Leu Asp Leu
325 330 335

Gly Ile Gly Leu Arg Tyr Asp Trp Gly Lys Phe Tyr Ala Ser Thr Ser
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Phe Tyr Asp Pro Ala Lys Asn Arg Arg Val Leu Met Gly Tyr Val Gly
355 360 365

Glu Val Asp Ser Lys Arg Ala Asp Val Val Lys Gly Trp Ala Ser Ile
370 375 380

Gln Ser Val Pro Arg Thr Val Ala Leu Asp Glu Lys Thr Arg Thr Asn
385 390 395 400

Leu Leu Leu Trp Pro Val Glu Glu Ile Glu Thr Leu Arg Leu Asn Ala
405 410 415

Thr Glu Leu Thr Asp Val Thr Ile Asn Thr Gly Ser Val Ile His Ile
420 425 430

Pro Leu Arg Gln Gly Thr His Ala Arg His Ala Glu Ala Ser Phe His
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Leu Asp Ala Ser Ala Val Ala Ala Leu Asn Glu Ala Asp Val Gly Tyr
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Asn Cys Ser Ser Ser Gly Gly Ala Val Asn Arg Gly Ala Leu Gly Pro
465 470 475 480

Phe Gly Leu Leu Val Leu Ala Ala Gly Asp Arg Arg Gly Glu Gln Thr
485 490 495

Ala Val Tyr Phe Tyr Val Ser Arg Gly Leu Asp Gly Gly Leu His Thr
500 505 510

Ser Phe Cys Gln Asp Glu Leu Arg Ser Ser Arg Ala Lys Asp Val Thr
515 520 525

Lys Arg Val Ile Gly Ser Thr Val Pro Val Leu Asp Gly Glu Ala Leu
530 535 540

Ser Met Arg Val Leu Val Asp His Ser Ile Val Gln Gly Phe Asp Met
545 550 555 560

Gly Gly Arg Thr Thr Met Thr Ser Arg Val Tyr Pro Met Glu Ser Tyr
565 570 575

Gln Glu Ala Arg Val Tyr Leu Phe Asn Asn Ala Thr Gly Ala Ser Val
580 585 590

Thr Ala Glu Arg Leu Val Val His Glu Met Asp Ser Ala His Asn Gln
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Arg His
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Thr Asp Trp Asp Asp Gly Met Glu Trp Gly His Ala Val Ser Arg
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Ser Gly Ser Met Thr Val Leu Pro
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Phe Arg Asp Pro Met Thr Ala Trp Tyr Asp

1 5 10

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Asp Trp Gly Lys Phe Tyr Ala Ser Thr Ser Phe
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 <222> (1)..(13)
 <223> Xaa is the nucleotide equivalent of any set containing "n"

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Glu Gln Trp Glu Gly Xaa Phe Met Gln Gln Tyr Xaa Xaa
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 <222> (1)..(15)
 <223> Xaa in position 11 is either phenylalanine or leucine

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Ala Val Pro Val Xaa Leu Xaa Xaa Pro Leu Xaa Ile Xaa Trp Val
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